

PATENT SPECIFICATION

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(54) LAMINATE AND PROCESS FOR PREPARING THE SAME

(71) We, FORMICA CORPORATION, a corporation organised under the laws of the State of Delaware, United States of America, of 4614 Spring Grove Avenue, Cincinnati, 5 State of Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the production of decorative laminates. More particularly this invention is concerned with a modification of the processes for producing decorative laminates with embossed surfaces which form the subject of our Patent No. 1,135,760.

In our earlier Patent we have described how the conventional method for preparing decorative laminates by heat- and pressure-consolidating a stacked assembly composed of a number of thermosetting synthetic resin-impregnated core sheets, typically of Kraft paper, and, above the core sheets, a print sheet carrying a printed decorative design and impregnated with a thermosetting resin which in the finished product will be transparent, may be modified in a simple manner to produce an embossed decorative laminate by the use of an "embossing design", by which is meant a raised printed design which will impart a raised surface to the corresponding print sheet. Two alternative processes utilizing such an embossing design are disclosed in the earlier Patent. According to one of these processes there is prepared between two flat metal plates an assembly in stacked relationship of:

- (1) a plurality of thermosetting synthetic resin-impregnated core sheets,
 - (2) the embossing design,
 - (3) the print sheet,
 - (4) a release sheet, and
 - (5) cushioning,
- after which the assembly is heat- and pressure-consolidated under conditions

which do not deform the embossing design. After removal of the metal plates, cushioning and release sheet at the conclusion of the consolidation step, there is obtained a laminate which has an embossed surface which is, using an analogy derived from photography, a "positive" image of the embossing design. As described in the parent Specification, the embossing design may be formed on the reverse side of the print sheet or it may be formed on a separate sheet.

The second process described in our earlier Patent differs essentially from the first in that the embossing design is positioned on the face of the release sheet remote from the print sheet, rather than between the core sheets and the print sheet. The need for separate cushioning material between the release sheet and the adjacent flat metal plate is avoided according to this second procedure, since the core sheets and print sheet which are to form the laminate provide the cushioning effect necessary to enable the laminate to be deformed on its surface whilst allowing the entire assembly between the flat metal plates to assume the flat surfaces required by the use of flat metal plates. The embossed design which is obtained in this case is the reverse or "negative" of the embossing design, which, of course, does not form a component of the final product. In this instance, the embossing design can be formed on a sheet of paper which is superimposed above the release sheet, or in some cases it can be formed on that surface of the release sheet which is remote from the print sheet.

Several ways in which the embossing design may be printed are described in the parent Specification. Thus, it is suggested that the composition for forming the embossing design may be applied to the appropriate carrier surface by techniques such as hand painting, air brush techniques, spray and stencil techniques and particularly

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silk screen techniques. Solutions or dispersions of comparatively high melt thermoplastic, thermosetting or thermoset resins are mentioned as being suitable compositions for forming the embossing design.

We have now discovered in accordance with this invention that aesthetically appealing laminates can also be obtained by either of the processes described in our earlier Patent when the embossing design comprises a raised design of hard particulate matter adhered to a flat carrier surface by means of an adhesive printed in that design and either (a) the print sheet has a surface of a single color or (b) the print sheet is replaced by a decorative sheet which has a surface of a single color and which is impregnated with a thermosetting synthetic resin which is transparent when cured.

As was the case with the techniques for forming the embossing means described in the parent Specification, the embossing design of this invention may be formed either on a separate sheet of paper or on the print sheet (or decorative sheet) or release sheet, according to which of the two alternative laminate-forming processes is employed. The particular carrier sheet selected is printed with a suitable flat design leaving an adhesive material in the printed areas. The type of printing employed depends upon whether or not the embossing design is to become a part of the final laminate, produced from the assembly. Where the embossing design is not to become a part of the final laminate, the printed flat adhesive design may be accomplished with a conventional printing ink which is adhesive until dried and hardened. Where the embossing design is to become a part of the final laminate, the flat design must be printed so as to be compatible with the print sheet. In addition to printing inks or the vehicles thereof, other adhesive compositions may be employed. Thus, various resinous materials which produce an adherent surface as a printed design may be similarly employed. For example, one can use thermosetting resins such as melamine-formaldehyde resins or other triazine resins, urea-formaldehyde resins, thiourea-formaldehyde resins and unsaturated polyester resins, as well as other adhesives such as various animal and vegetable glues or synthetic contact adhesives such as poly(cyanoethyl acrylate). As pointed out above, where necessary, the adhesive will be in a tacky condition when treated with the particulate materials described next.

Use is next made of small hard particulates which are forced to adhere to the adhesive design thereby producing a raised design substantially immediately after the adhesive design has been printed and before the adhesive has had an opportunity to solidify and harden, where this aspect is to be

considered. These small hard particulates may be any one of a plurality of available materials such as sand, ground glass, sugar, salt and finely divided thermoset resinous materials. In order to achieve the adherence of these small hard particulates to the adhesive design so as to produce a raised printed surface, one may print the adhesive design on the selected sheet such as by a silk screen printing process, the thus printed sheet is then passed through a zone containing the hard particulates wherein the particulates contact the adhesive print and automatically become bonded thereto. In those instances where appropriate, the sheet containing the design plus particulates may next be dried to the thermoset condition.

As has been noted, the print sheet and decorative sheet are both characterized by having a surface of a single color, the term "color" including white. In the case of the print sheets, the colored surfaces are obtained by a printing process. In this art, the term "printing" is used rather broadly to denote any process in which pigment is applied to the surface of a sheet in an accurately reproducible manner, and therefore includes techniques such as hand painting and spraying through a stencil, as well as conventional printing methods such as the silk screen, gravure and thermographic processes. The decorative sheets differ essentially from the print sheets only in that the surfaces of a single color are obtained by means other than printing. For example a decorative sheet having a white surface can be obtained by the use of a pigmented paper. Whether a print sheet or a decorative sheet is employed, the sheet is impregnated with a thermosetting resin which is transparent when cured. Suitable, thermosetting synthetic resins include, for example, melamine-formaldehyde and other triazine resins, urea-formaldehyde resins, thiourea-formaldehyde resins and unsaturated polyester resins. In preparing the print or decorative sheets, the resin-impregnation step may precede the application of a colored pigment thereto, or there may be used a sheet which is pre-colored.

Part from the use of an embossing design which comprises a raised design of hard particulate matter and, optionally, a decorative sheet in place of a print sheet, the present invention may be carried out by the techniques described in the parent Specification, which techniques are in fact largely conventional.

The invention is illustrated by the Examples which follow.

Example 1

A stack of nine phenolic resin-impregnated Kraft core sheets are arranged in superimposed relationship on a polished steel

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- plate. Above the Kraft paper sheets there is positioned a solid yellow color melamine resin - impregnated α - cellulose decorative sheet. Above this decorative sheet is positioned a release sheet comprising aluminum foil having bonded to its upper surface a sheet of thin tissue paper onto which circular designs have been printed in flat design after which small hard particulates in the form of common table salt have been adhesively adhered. The adhesive employed was a polydialyl phthalate resin containing a conventional peroxide polymerization catalyst and said resin was cured to a thermoset condition after application of the particulates. Above the release sheet there is positioned two layers of Kraft paper not impregnated with any resinous material and designed to function as a paper cushion. Thereupon, a second polished plate is placed above the Kraft paper cushions and the entire assembly is subjected to heat and pressure to produce the laminate. After cooling, the assembly is removed from the press and the plates and release sheet including the Kraft paper cushions are removed from the laminate. There is obtained a yellow laminate highlighted by a decorative embossed pattern of circular designs.
- Example 2**
- The procedure of Example 1 was generally followed. The number of Kraft core sheets was reduced to three. The color of the decorative sheet was white obtained by the use of a pigmented paper. The embossing design was incorporated on the back of the decorative sheet. The adhesive was an epoxy resin which was printed in flat design as a series of interconnecting lines forming diamonds of approximately $\frac{1}{16}$ square inch in area. The hard particulates were of sand after their application to the design area, the epoxy resin was cured to the thermoset condition. There was obtained a white laminate highlighted by a decorative embossed pattern of diamond shapes. In this example the embossing design became a part of the laminate formed and the decorative pattern was raised with respect to the surface of the laminate.
- Example 3**
- The procedure of Example 1 was followed. The number of Kraft core sheets was six. The color of the decorative sheet was red. The embossing design was incorporated as a separate sheet positioned just below the decorative sheet in the laminate assembly. This sheet was impregnated with a melamine resin of the same quality as employed in impregnating the decorative sheet. A flat scroll design was printed upon this sheet with a hot vinyl resin, employing gravure techniques, adding ground glass particulates to the design before the vinyl resin had solidified. There was obtained a red laminate high-lighted by a decorative embossed pattern of scroll design. In this example the embossing design became a part of the laminate formed and the decorative pattern was raised with respect to the surface of the laminate.

WHAT WE CLAIM IS:—

1. The process for producing a decorative laminate defined in Claim 1 or Claim 2 of Patent No. 1,135,760 modified in that the embossing design comprises a raised design of hard particulate matter adhered to a flat carrier surface by means of an adhesive printed in that design, the print sheet having a surface of a single color.
2. The process of producing a decorative laminate defined in Claim 1 or Claim 2 of Patent No. 1,135,760 modified in that (a) the embossing design comprises a raised design of hard particulate matter adhered to a flat carrier surface by means of an adhesive printed in that design, and (b) the print sheet is replaced by a decorative sheet which has a surface of a single color and which is impregnated with a thermosetting synthetic resin which is transparent when cured.
3. A process for producing a decorative laminate according to Claim 1 or Claim 2 and substantially as hereinbefore described.
4. A decorative laminate whenever produced by a process according to any preceding claim.

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